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Increasing outcomes of the results learn through project based learning

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Abstract. The purpose of the research is to know the effectiveness of learning outcomes of light vehicle engine maintenance subjects between students who are following a project based learning models compared with students who are following learning with conventional models. The type of this research is Quasi-experimental with a population consist of 54 students and divided into two classes, namely XI TKR 1 and XI TKR 2. The samples were taken on a clustered basis and found XI TKR 2 class as an experimental class with 27 students and XI TKR 1 class as an control class consist of 27 students. The instrument of data collection is used multiple choice tests. The technique of data analysis using descriptive, the prerequisite test analysis using a normality test and homogeneity test, while the hypothesis is using t-test. The results of the study were the results of learning by implementing a project based learning models in the experimental class higher than applying conventional models in control class. This can be proved by testing the t-test in the post-test between the experiment and control class which shows the t-hitung > t-tabel value, (2,189 > 1,674) and its significance value is less than 0.05 (P = 0.02 < 0.05).

Keywords: project based learning model, machines

Introduction

Vocational High School (SMK) is one of the middle level formal education institutions that aims to improve intelligence, knowledge, personality, noble character, and the skills of students to live independently and follow further education in accordance with their vocational [1]. In order to work effectively and efficiently and develop skills and skills, students must have high stamina, master their fields of expertise and the basics of science and technology, have a high work ethic, and be able to communicate according to the demands of their work, and have the ability to develop self.

Based on unemployment data obtained from the official Central Statistics Agency (BPS) in the past year, unemployment has fallen by 40 thousand people, in line with the open unemployment rate which dropped to 5.34 percent in August 2018. Judging from the level of education, the unemployment rate is open to Vocational High Schools (SMK) still dominate among the other levels of education, which is 11.24 percent [2]. Based on the BPS data, there are still many vocational high school (SMK) graduates who are unemployed. This can be influenced by several factors such as curriculum, teaching and learning activities, costs, facilities and infrastructure, students themselves.

AAG Adisutjipto Flight Vocational School is a favorite Vocational School especially in the aviation industry, which has a commitment of realizing a generation of migrants who are of high quality, character, have a high level of discipline, and are able to keep up with technological developments. AAG Adisutjipto Vocational High School has four expertise study programs, namely Air Frame and Power Plane, Avionic Electronic Instrumentations Maintenance and Repair, Aircraft Electricity, and Light Vehicle Engineering.

One of the subjects studied in the light vehicle engineering expertise program is the AAG Vocational School Aditujipto is the maintenance of light vehicle engines. The basic competency of light vehicle engine maintenance subjects is understanding the way. take care of the engine regularly and how to take care of the engine regularly

From the results of the observations at the time of learning students were still not able to

master the basic competencies of these subjects, as evidenced by the results of midterm assessment PTS (PTS), out of 56 students from 56 students there were 26 students who scored above the rest of the KKM under the KKM. To improve learning outcomes, maintenance of light vehicle engines requires a learning process that can involve students actively in the learning process so that learning outcomes in light vehicle engine maintenance subjects increase [3].

Based on Internship III observations in September to December 2018 in Flight Vocational Schools, the learning process for maintaining light vehicle engines in Flight Vocational Schools uses a learning model that is not in accordance with planning, so that the learning model used seems conventional like the lecture method. According to [4] states that in conventional learning students are placed as learning objects that act as recipients of information passively, so that it seems one-way. This causes teachers and students to interact less with each other. There are still many students who are still having difficulty understanding the material presented. They are easier to understand the material conveyed in the form of practice and connected in the industrial world. Therefore we need a Project based learning model.

Project Based Learning (PjBL) or project-based learning is an innovative learning approach, which emphasizes contextual learning through complex activities. The focus of learning lies in a study discipline, involving students in investigating problem solving and other meaningful task activities, giving students the opportunity to work autonomously in constructing their own knowledge, and reaching the peak of producing real products [5].

Learning Results for Light Vehicle Engine Maintenance

According to [3], student learning outcomes in essence are changes in behavior as learning outcomes in a wider range of fields including cognitive, affective, and psychomotor fields. Other opinions suggest that learning outcomes are evidence of the success achieved by students where each learning activity can cause a distinctive change [6]. In line with this, according to [7] learning outcomes are the result of an interaction between learning and teaching. From the teacher's side it ends with a process of evaluating learning outcomes. In terms of students, learning outcomes are the end of teaching and the peak of the learning process.

Hasil belajar pemeliharaan mesin kendaraan ringan dipandang sebagai perwujudan nilai-nilai yang diperoleh siswa SMK melalui proses belajar. Dalam hal ini, hasil belajar merupakan penguasaan kompetensi-kompetensi yang dicapai oleh siswa dalam mengikuti program belajar sesuai dengan tujuan pendidikan yang telah ditetapkan. Hasil belajar ini mencerminkan keberhasilan proses belajar dan sistem pendidikan yang dikembangkan, artinya bahwa siswa mampu menguasai materi pembelajaran pemeliharaan mesin kendaraan ringan yang dijelaskan oleh guru selama proses pembelajaran berlangsung, materi yang disampaikan disesuaikan dengan kompetensi dasar mata pelajaran tersebut. Kompetensi dasar dapat di jelaskan pada tabel 1 sebagai berikut:

Table 1. Basic Competencies for Light Vehicle Engine Maintenance

No	Basic Competence for Light Engine Maintenance
1	Understand how to care for machines regularly (periodic service)
2	Take care of the machine regularly (periodic service)
3	Understand the gasoline fuel system
4	Repairing the gasoline fuel system

Conventional Method

Conventional methods are methods that have often been used by teachers in the learning process. This learning is one of the teacher-centered learning methods. States that in conventional learning students are placed as learning objects that act as passive recipients of information [4]. So in general the delivery of lessons uses the lecture method, question and answer and assignment. According to [8], conventional learning is done in one direction. In this learning the students also work on two activities, namely listening and taking notes. Conventional learning is learning that has long been used. This conventional method is still used by AAG Adisutjipto Vocational School teachers, the method includes lecture methods and demonstration methods.

According to [9], the lecture method is a method that until now is often used by every teacher or instructor. This is besides being caused by certain considerations, there is also a habit factor both from the teacher and students. Teachers usually do not feel satisfied when in the learning management process does not conduct lectures.

Demonstration method

According to [10], the demonstration method is carried out by demonstrating the event, the way the tool works, or the sequence of activities either directly or assisted by learning media in accordance with the learning material. Demonstrations can be performed by teachers, students, or other people who are considered to be able to demonstrate the tool. The demonstration method aims to clarify the concept and process of something happening because students see the process for themselves. By seeing a process for yourself, students' impressions of learning material are expected to be deeper ...

Project Based Learning Learning Model

The Language Based Learning Model Project Learning is defined as a model that emphasizes the procurement of projects or small research activities in learning. According to CORD et al., project-based learning is an innovative learning model and emphasizes contextual learning through complex activities [11]. The focus of learning lies in the core principles and concepts of disciplines, involving students in investigating problem solving and other meaningful tasks, giving students the opportunity to work autonomously in constructing their own knowledge, and reaching the peak to produce tangible products. Furthermore according to [12] project based learning can stimulate motivation, process, and improve learning outcomes by using problems related to certain subjects.

In addition, according to [13] the learning process of Project Based Learning refers to the activities of students in designing, planning and implementing a sustainable project that produces something that can be exhibited such as products, publications and or presentations.

Based on the opinions of the experts above, it can be concluded that project-based learning is learning that emphasizes active berberan students in completing agreed projects, so that in the learning process can increase learning outcomes. The steps of applying the project based learning learning model can be seen in table 2 as follows

Table 2. Steps for Project-Based Learning

No	Activity	Steps
1	Starting with essential questions	Taking topics that match the realities of the real world begins with an in-depth investigation. Essential questions are asked to provoke knowledge, responses, criticisms, and ideas of students on the topic to be raised.
2	Planning the project execution rules	Planning contains the rules of the game, the selection of activities that support in answering essential questions, by integrating various possible subjects, and knowing tools and materials that can be accessed to assist in project completion
3	Make an activity schedule	Educators and students collaboratively schedule activities to complete projects. This schedule is structured to know how long it will take to carry out the project.
4	Monitoring the development of student projects	Educators are responsible for monitoring the activities of students while completing the project. Monitoring is done by facilitating students in each process..
5	Assessment of student work outcomes	Assessment is carried out to help students measure standard achievement, play a role in evaluating the progress of each student, giving feedback about the level of understanding that has been achieved by students, helping educators develop the next learning strategy.
6	Evaluate the learning experience of students	At the end of the learning process, educators and students reflect on the activities and results of the projects that have been implemented. The replication process is carried out both individually and in groups. At this stage students are asked to express their feelings and experiences while completing the project..

Sumber: [12]

Project based learning is a superior driver to help students learn to do authentic and multidisciplinary tasks, use limited resources effectively and work with others [12]. Experience in the field from both teachers and students that project based learning is beneficial and effective as learning, besides it has a high value to improve the quality of student learning, so that after the activity is carried out it allows students of AAG Adisutjipto to gain more effective results on maintenance subjects light vehicle engine.

Research methods

The research was conducted at AAG Adisutjipto Flight Vocational School. The study used a quasi-experimental type. Research design classified as pre-experimental can be seen in table 3.

Table 3: Research Design

Pre-test Class Post-test Treatment

O1 X O2 experiment

O3 - O4 control

Information:

X: treatment using the Project Based Learning model

-: without treatment or treatment with conventional models

O1: Experimental class Pre-Test Results

O2: Experimental class Post-Test results

O3: Pre Test result of the control class

O4: Post Results of the Control Class Test

The population in the study were students of Vocational School AAG Adisutjipto class XI Light Vehicle Engineering 2018-2019 academic year, the class was divided into 2 classes namely XI TKR1 class with 28 students while the XI TKR2 class with 28 students, so with a total of 56 students students.

The sample used in the study is Cluster Random Sampling. The sample obtained was the XI TKR1 students as the control class and the TKR2 XI as the experimental class

Data collection used a preliminary test (pre-test) conducted at the beginning to find out the balance of abilities possessed by students, while the final test (post-test) was a test conducted at the end to measure learning outcomes in the experimental class and the control class.

The pre-test instrument test results obtained 22 valid items with a reliability of 0.789 (high category). While the results of the post-test instrument test showed that 22 items were valid and reliability was 0.768 (high category).

Control of internal validity is done to anticipate the possibility of influencing learning outcomes so that learning outcomes in research are really influenced by the results of treatment, there are also internal validity controls, namely: 1). History (History); 2). Maturity; 3). Statistical regression; 4). Pre-test administration; 5). Lost in Experiments; and 6). Measuring instrument.

Data analysis technique

Data analysis techniques used to determine the differences in learning outcomes of TKR XI grade students of AAG Vocational High School Adisutjipto light vehicle engine maintenance subjects are t test of the initial ability and hypothesis t test. Test analysis requirements were measured using the normality and homogeneity test. The hypothesis in this study is that the learning outcomes of light vehicle engine maintenance subjects between students who follow the Project based learning model are more effective than students who follow learning with conventional learning models.

Results and Discussion

The Balance Test is carried out in the form of a pre-test before the teacher gives an explanation of the material and applies the learning model. Data description can be seen in table 3

Table 3. Description of Balance Test Data

No	Class	Total of students	Median	Modus	Varians	Min	Max	Mean	Standar Devisiasi
1	Experimental	27	68,2	68,2	130,85	50	86,4	68,7	11,44
2	control	27	68,2	72,7	129,5	50	86,4	68,4	11,38

After the data description is carried out, the data analysis prerequisite test is then carried out

The analysis prerequisite test results can be seen in table 5

Table 4. Prerequisite test for pre-test data analysis

No	Uji Normalitas			Uji Homogenitas		
	Class	**Sig**	**Conclusion**	**test**	**Sig**	**Conclusion**
1	Experimental	0,164	Normal	*Pre-test*	0,743	Homogen
2	Control	0,200	Normal			

Based on table 4. The results of the pre-test results of both experimental and control classes have a sig> 0.05 value, it can be concluded that all tests are normally distributed and the pre-test homogeneity test results of this study are known to have a significant value of 0.743 greater than 0.05 (sig> 0.05) it can be concluded that the data in this study have homogeneous variances. After the requirements for data analysis are met, analysis of balance test data can be carried out. The results of the analysis can be seen in table 5.

Table 5 . Summary of Balance Test

class	**Mean**	**t count**	**P**
***Pre-Test* experimental class**	68,688	0,109	0,914
***Pre-Test* control class**	68,350		

Table 5. Explain the results of the Pre-Test t test on the average learning outcomes of the experimental class at 68,688 and the average control class learning outcomes amounted to 68,350, from the table it is known that t_{hitung} amounting to 0.109 with a significance of 0.914 and while t table 1.675 at the significance level of 0.914. Then the value of tcount <t table (0.109 <1.675) and its significance value is more than 0.05 (P = 0.914> 0.05).

It can be concluded that student learning outcomes in the experimental class and the control class are the same on the subjects of light vehicle engine maintenance class XI Light Vehicle Engineering AAG Adisutjipto. So that the experiment will be carried out with different treatments, the experimental class will be treated using the Project Based Learning model while the control class uses the conventional method.

Based on the results of the balance test, experiments can be conducted with different treatments. the control class uses conventional learning methods while the experimental class uses the Project based learning learning model. Descriptions of post-test data can be seen in table 6.

Table 6 . Description of post-test data

No	**Class**	**Total of students**	**Median**	**Modus**	**Varians**	**Min**	**Maks**	**Mean**	**Standar Devisiasi**
1	Eksperimental	27	77,3	77,3	94,71	63,6	95,5	78,5	9,73
2	Control	27	72,7	72,7	100,89	54,5	90,9	72,6	10,04

After the data description is carried out, the data analysis prerequisite test is carried out. The analysis prerequisite test results can be seen in table 7

Table 7 Prerequisite test for post-Test data analysis

No	Normalitas test			Uji Homogenitas		
	Kelas	**Sig**	**Conclusion**	**Uji**	**Sig**	**Conclusion**
1	Eksperimental	0,200	Normal	*Pre-test*	0,782	Homogen
2	Control	0,155	Normal			

Based on table 8. The results of post-test learning outcomes both experimental and control classes have sig> 0.05, it can be concluded that all tests are normally distributed and the post-test homogeneity test results show a significant value of 0.782 greater than 0.05 (sig > 0.05) it can be concluded that the data in this study have homogeneous variances. After the requirements for data analysis are met,

hypothesis testing can be done, the results of hypothesis testing can be seen in table 8.

Table 8 . Hipotesis Test

Class	mean	t count	P
Post-Test **experimental class**	78,45	2,189	0,02
Post-Test **control class**	72,56		

Table 8. Explain the results of the Post-Test t test on the average experimental class learning outcomes of 78.45 and the average control class learning outcomes of 72.56, so it can be concluded that the average experimental learning outcomes are more than 5.89 compared to the control class of the table it is known that tcount is 2.189 with a significance of 0.02 and while ttable is 1.674 at a significance level of 0.02. So the value of tcount> t table (2.189> 1.674) and the significance value is less than 0.05 (P = 0.02 <0.05).

It can be concluded that student learning outcomes are more effective in the experimental class than the control class in the light vehicle engine maintenance class XI Light Vehicle Engineering Department of AAG Adisutjipto Vocational School.

Based on data from the results of the research conducted, it is known that the learning outcomes of light vehicle engine maintenance subjects in the experimental group were higher than the control group. The experimental group uses the PjBL model in the project plan and the way to complete the project, the selection of problems presented is adjusted to the material studied by the students. The material studied in the form of this research is the problem that occurs in periodic engine maintenance and fuel systems which are included in the maintenance of light vehicle engine subjects. The results of this study are in line with the results of a study conducted by [14] stating the results of higher learning achievement using the Project Based Learning model, besides the results of research conducted by [15] show that the results of implementing a project based learning model are more effective cognitive, affective, and psychomotor students in electrical installation engineering subjects. In connection with this, the results of research by [16] state that the project-based learning method has a positive effect on learning motivation. The results of the study were carried out on vocational education the same as was done in this study. With these two results, it means that the project-based learning method is very suitable for use in vocational schools. Other research results conducted by [17] The method of project based learning increases learning motivation and learning outcomes in advanced las courses in each cycle carried out.

Submission of material delivered using the Project Based Learning model is more effective than delivering conventional methods such as lectures and demonstrations. This is because the Project Based Learning model can adjust to the conditions in the TKR Department of the XI class of AAG Adisutjipto Flight Vocational School. Giving projects related to life that are close to students, can train students to be able to think critically. The stages of learning using the PjBl are: 1) the stage of giving an essential question to determine the project title to be done by students, 2) the stage of making a project work schedule schedule where the teacher and students collaboratively arrange the activity schedule in completing the project, 3) monitoring the development of project students in this case the teacher is responsible for monitoring the activities of students during completing the project, 4) the stage of evaluating the project results in this case the students represent the results they are working with the group.

The steps described above are in line with [18] opinion in his journal suggesting three basic components in implementing project-based learning methods, namely: 1) project design, 2) project implementation, and 3) project evaluation. Project design is the basic design of a project planned by educators that will be used as content in learning. Project implementation is a major part of project-based learning and is a process for educators to carry out teaching and learning activities with students. In this component there are three important stages, namely: 1) project introduction, 2) subproject implementation, and 3) subproject integration. Project evaluation is an assessment of the process and learning outcomes of students. Suggests that the steps of the project-based learning method are as follows: (1) Get An Idea (Getting a Project Idea); (2) Design The Project (Planning the Project); (3) Tune The Project (Preparing the Project); (4) Do The Project (Doing Projects);

and (5) Exhibit The Project (Project Exhibition) [13].

The use of Project Based Learning models provides benefits to improve learning outcomes in accordance with the results of data processing above, in addition project based learning is a superior driver to help students learn to perform authentic and multidisciplinary tasks, use limited resources effectively and work with people. more. Experience in the field both from teachers and students that project based learning is beneficial and effective as learning, besides it has high value to improve the quality of student learning [12]. A similar definition also expressed by [19] in the journal definition of project-based learning leads to a project that integrates science, technology, society, history, mathematics, politics and even art that triggers students to discuss productively and give freedom in learning seen as answers to questions as learning strategies. In addition, besides that [20] in his journal three new centers of project-based learning is student-centered (subject), centered on training and exploration, centered on project activities. Project-based learning is very practical and requires students to research project titles, production projects, with various resources to conduct inquiry-based learning, problem solving, to complete projects, and reflect and evaluate their work. During the completion of the project in active construction of knowledge, access to appropriate knowledge, skills and practical experience, students of all abilities, so that knowledge becomes a skill.

While in the learning control class using the lecture method and demonstration does not give students the ability to optimize their abilities. Based on the results of the post-test obtained, the control class was lower than the experimental class, and there were only a few students who were active in the class. While other students are not accustomed to actively doing questions or responding to questions. This is because the teaching methods of teachers in the control group material delivery seem boring and uninteresting so that the enthusiasm of students to pay attention to what is explained by the teacher is also reduced. The conventional method is less appropriate for learning which aims to solve problems that occur around everyday life. In the opinion of [21] the weakness of the lecture method is 1) easy to become verbalism (understanding of the word); 2) the visual becomes a loss, the big auditive (hears) receives it; 3) if always used and too long, boring; 4) the teacher concludes that students understand and are interested in the lecture, this is very difficult; 5) causes students to be passive. While the demonstration method has weaknesses according to [22] the demonstration method has weaknesses namely: 1) This method requires teacher skills specifically, because without being supported by this, the implementation of the demonstration will be ineffective; 2) facilities such as equipment, places and adequate costs are not always available properly; 3) demonstrations require careful preparedness and planning in addition to requiring a considerable amount of time, which may be forced to take another time or class. This is inversely proportional to the Project Based Learning model which emphasizes contextual learning through complex activities.

Conclusion

Based on the results of the research and discussion conducted, it was concluded that: Learning outcomes by applying project based learning learning models were more effective than applying conventional methods. This is evidenced by this. It can be proven by testing the t-test on the post-test between the experimental and control classes which shows the value of t-test> t table, (2.189> 1.674) and the significance value is less than 0.05 (P = 0.02 <0 , 05) thus Ha is accepted.

Suggestion

Teacher teachers should use a learning model that can involve students actively seeking their own solutions to problems that occur around them in the learning process, so that students actively seek their own problems that occur can increase students' understanding, one of the recommendations of researchers is to implement project based learning models learning.

Teachers should in the process of learning in class not be the center of learning and become the only source of information for students. Such learning process will only make students bored and bored so that students find it difficult to understand the material being taught. Trying to implement project based learning model learning, one model that can improve learning outcomes and reduce student saturation from the learning process.

In order to be able to implement the learning model of project based learning in the classroom, teachers need to prepare suitable teaching materials and make anticipations of responses that might arise from students. The student activity sheet prepared should contain learning indicators as well as problems that challenge and give rise to a sense of wanting to solve the problem.

The teacher should only function as a facilitator, motivator, evaluator in the learning process by using a project based learning model.

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